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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/656,248	09/08/2003	Ming-Yi Lay	010011A	8856

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EXAMINER

WILCZEWSKI, MARY A

ART UNIT PAPER NUMBER

2822

DATE MAILED: 08/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/656,248

Applicant(s)

LAY ET AL.

Examiner

M. Wilczewski

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 May 2005 and 31 May 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 11-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 11-15 is/are rejected.
- 7) ☒ Claim(s) 16-19 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/764,207.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

This Office action is in response to the amendments filed on May 9 and May 31, 2005.

Priority

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed in parent Application No. 09/764,207, filed on February 5, 2004.

Drawings

The drawings, filed on September 8, 2003, have been approved, by the Examiner.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 11-15 are again rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al., U.S. Patent 6,232,563, in view of Murakami, JP4-196434, both of record, further in view of Nakazawa, US 2001/0013651, newly cited.

Kim et al. disclose a method of forming a plurality of metal bumps (Figure 6A) comprising providing a chip 11 with a plurality of metal pads 12, forming a photoresist 15 on the chip, performing an etching process to remove the photoresist layer covering

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the metal pad so as to form a hole that exposes the metal pad (see figure 3B), filling the hole with a metal layer 16' comprising Au (see figure 3C and column 4, lines 39-47), completely removing the photoresist (see figure 3D), depositing an insulating layer 18' such as silicon nitride on the chip to cover the metal layer (see figure 5B and column 4, lines 47-56), and performing an etching step to remove the insulating layer 18' positioned on the top of the metal layer so as to leave the insulating layer positioned on the sidewall of the metal layer (see figure 5D and column 4, lines 56-65).

Kim lacks anticipation only of removing the insulating layer by an anisotropic dry etching process and of removing the portion of the insulating layer that is on the surface of the chip. Murakami discloses a method of forming a gold bump in which insulating sidewall spacers are formed on the sidewalls of the Au bump in order to improve the reliability of the Au bump. Murakami teaches to perform an anisotropic dry etching process on a deposited insulating layer in order to remove the insulating layer on the top of the bump and on the surface of the chip, see the English-language abstract and figures 1(a)-1(c). Therefore, in order to improve the reliability of the gold bump formed in the method of Kim et al., it would have been obvious to one skilled in the art to use an anisotropic dry etching process in the known method of Kim et al. to remove the insulating layer positioned on top of the bump and on the surface of the chip.

In the method of Kim et al., under bump metallization (UBM) consisting of barrier layer 14', 14 is formed over metal pad 12, see, for example, figures 3A, 3E, and 4. In the arguments filed on May 9, Applicants have argued that neither Kim nor Murakami, when taken alone or in combination, teaches or suggests "performing an etching

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process to remove the photoresist layer covering the metal pad so as to form a hole that exposes the metal pad" as recited in amended claim 11. While Kim et al. clearly teaches removing a photoresist layer covering the metal pad 12, as shown in figure 3B, since under bump metallization (barrier layer 14', 14) is formed over the metal pad, this removing step does not **expose** the metal pad. However, it is well known in the art that if a bump electrode is formed by electroless plating, the bump electrode can be formed directly on the metal pad, see Nakazawa, Pub. No. 2001/0013651, abstract and paragraphs [0007]-[0009]. The elimination of the under bump metallization decreases the cost of manufacturing the metal bumps and decreases the complexity of the manufacturing process by decreasing the number of processing steps required to form the metal bumps, therefore, it would have been obvious to one skilled in the art to eliminate the barrier layer used in the known method of Kim et al.

Claim Objections

Claims 16-19 are objected to because of the following informalities:

In claim 16, in line 5 "removing" should be changed to --remove--. In line 9, "remain" is used incorrectly. It is suggested that "remain" be changed to --to leave--. At the end of line 10, the question mark, "?", should be replaced with a semi-colon, ";".

Appropriate correction is required.

Response to Arguments

Applicant's arguments with respect to claims 11-15 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additionally cited references disclose various methods of forming bump electrodes wherein the under bump metal layer(s) is not required or is optional.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to M. Wilczewski whose telephone number is (571) 272-1849. The examiner can normally be reached on Monday and Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



M. Wilczewski
Primary Examiner
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